Advanced Design and Manufacture of Cryogenic Propellant Tanks for Air Launched Liquid Rocket

Completed Technology Project (2016 - 2018)

Project Introduction

Generation Orbit (GO) is developing sub-orbital systems to enable rapid and inexpensive hypersonic flight regime test capabilities. To keep the cost of their launch system low, GO acts as systems integrator, utilizing as many off-the-shelf components as possible. But they do need to develop a few custom components, such as the liquid oxygen and the kerosene tanks. As a low risk approach, they started with design and manufacture of a metallic tank. But they think they may gain additional cost and/or weight efficiency by using composite tanks, especially tow-steered designs permitting efficient load path tailoring. Currently, GO does not have in-house composite structures expertise, so they asked for NASA's help. Through this partnership, NASA plans to use load path tailoring to evaluate whether tow-steered composite design can reduce liquid oxygen tank weight relative to the metallic design. Feasibility of a successful composite cylinder design should be demonstrated by manufacture of demonstration units using LaRC's Integrated Structural Assembly of Advanced Composites (ISAAC) and subjecting them to nondestructive evaluation and subscale testing.

Anticipated Benefits

NASA funded: ACLO enables autonomous operation of cryogenic systems through development of physics-based software models and simulations that assist engineers and operators with designing cryogenic systems, optimizing propellant loading regimes, and supervising control and recovery functions. NASA Unfunded: The automation of functions and processes within the architecture and the integration of IVHM capabilities will ultimately provide repeatable, reliable loading operations and will reduce the heavy reliance on highly-skilled, highly-trained personnel to operate and maintain ground systems and to conduct launch operations. OGA: None. Commercial: The automation of functions and processes within the architecture and the integration of IVHM capabilities will ultimately provide repeatable, reliable loading operations and will reduce the heavy reliance on highly-skilled, highly-trained personnel to operate and maintain ground systems and to conduct launch operations. Nation: The technologies developed by the AS-ACLO team can help mature concepts for variable levels of autonomy and can enable us to rapidly adapt to and support various launch concepts in a multi-use environment, increase system availability, and reduce operations and maintenance costs associated with cryogenic systems.

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Game Changing Development

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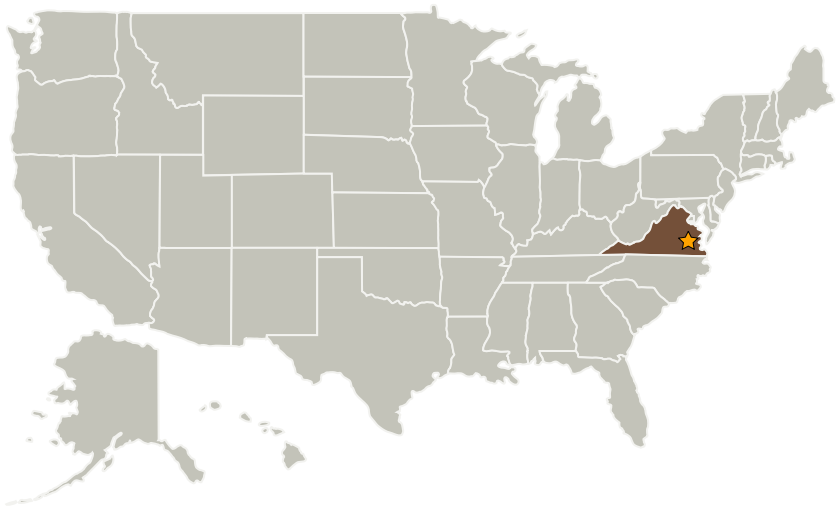
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

February 2016: Project Start

March 2018: Closed out

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Game Changing Development

Project Management

Program Director:

Mary J Werkheiser

Program Manager:

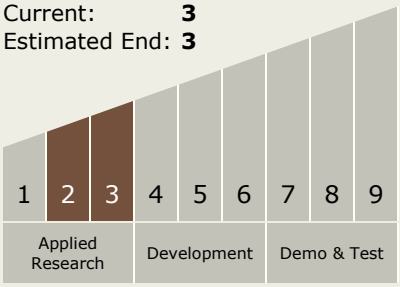
Gary F Meyering

Principal Investigator:

Monica F Hughes

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Target Destination

Others Inside the Solar System